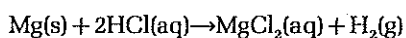


8.6 Concentration and reaction rate

For reactions in solution, the rate of a reaction depends on the concentration of one or more of the reactants. The concentration of reactants is highest at the beginning of a reaction. The concentration then decreases as the reactants are used up.

The effect of concentration on reaction rate can be studied by investigating the reaction between magnesium and dilute hydrochloric acid.



Aim

To investigate the effect of concentration on the rate of reaction of magnesium and dilute hydrochloric acid.

Apparatus and materials

Conical flask, 100 cm³
Stopclock or timer
Measuring cylinder, 100 cm³
Graph paper
Emery paper
Scissors
Magnesium ribbon, 18 cm length
Dilute hydrochloric acid solutions of concentration 2.0, 1.5, 1.2, 1.0, 0.8 and 0.5 mol dm⁻³

Procedure

- 1 Clean a piece of magnesium ribbon by drawing it through emery paper.
- 2 Cut six separate pieces of magnesium ribbon exactly 3 cm long.
- 3 Use the measuring cylinder to pour 60 cm³ of 0.5 mol dm⁻³ hydrochloric acid into the conical flask.
- 4 Drop one of the pieces of magnesium ribbon into the acid. Start the timer.
- 5 Stop the timer immediately when the ribbon disappears.
- 6 Clean out the conical flask and repeat steps 1–5 with each of the acid solutions.

Results

Copy and complete the table at the top of the next column.

Plot a graph of concentration (vertical axis) against time taken for the magnesium to disappear (horizontal axis).

concentration/mol dm ⁻³	time/s
0.5	
0.8	
1.0	
1.2	
1.5	
2.0	

Extra work

- Repeat the experiment using other concentrations of dilute hydrochloric acid (see question 2).

Questions

- 1 a) Which acid concentration causes the magnesium to disappear fastest?
b) In this reaction which material is used in excess: magnesium or hydrochloric acid?
c) Use your graph to estimate the time taken for 3 cm of magnesium ribbon to react with 60 cm³ of 1.7 mol dm⁻³ hydrochloric acid.
d) How would you show that the gas produced by the reaction is hydrogen?
e) Name the chemicals left in the flask when the experiment has finished.
- 2 The table below shows the volumes of 2 mol dm⁻³ hydrochloric acid and water that need to be mixed to produce acids of different concentrations.

volume of dilute hydrochloric acid/cm ³	volume of water/cm ³	concentration/mol dm ⁻³
60	0	2
50	10	
40	20	
30	30	1
20	40	
10	50	

Copy and complete the table.